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FAO Plant Protection Bulletin

VOL. II, No. 3 A Publication of the DECEMBER 1953

World Reporting Service on Plant Diseases and Pests

The Desert Locust Situation, 1952/53

O. B. LEAN

Expanded Technical Assistance Program, Agriculture Division, FAO

SINCE an earlier account on the desert locust situation up to September 1952 was published [1], the plague has continued with varying intensity through the invasion zone from India to the Atlantic coast of West Africa and from Turkey to Tanganyika. During this period intensified efforts were made to control the desert locust; campaign organizations were strengthened, new techniques developed and countries worked increasingly together in planning for concerted action and in providing mutual assistance.

Though these improved measures succeeded in checking the plague sufficiently to avoid extensive crop damage, they did not prevent a general expansion of the plague which, in November 1953, was more widespread and potentially more dangerous than at the corresponding period in 1952.

The following list of territories affected by the desert locust in October and November 1953 indicates how extensive the plague has become:

Aden Protectorate	Kuwait
Algeria	Mauretania
British Somaliland	Nigeria
Egypt	Oman
Ethiopia	Pakistan
French Cameroons	Saudi Arabia
French Morocco	Senegal
French Niger	Somalia
French Sudan	Spanish Sahara
India	Sudan
Iran	Syria
Iraq	Tanganyika
Israel	Tchad
Jordan	Tunisia
Kenya	Yemen

[1] LEAN, O.B. *The desert locust situation.* FAO Plant Prot. Bull. 1: 2–4. 1952.

Spread of the Plague

In the Eastern Region the extensive 1952 monsoon breeding in India and Pakistan, though largely controlled, produced a number of swarms which migrated into Iran, Oman and Saudi Arabia. Some of these, moving up the Persian Gulf, reached Kuwait in October and later spread to Jordan. Other swarms, possibly of the same origin, arrived in the Aden Protectorate and Yemen in November. Some crossed to Africa.

The further spread of swarms of this generation, reinforced by swarms derived from uncontrolled breeding in Yemen, resulted in widespread spring breeding in Arabia, southern Iraq, Jordan and southern Iran.

During the autumn of 1952, while these swarms from the eastern monsoon breeding areas overspread the Near East, other swarms which had remained in eastern Africa bred in the Somali Peninsula (British Somaliland, northern Somalia and southeastern Ethiopia). Benefiting from the experience of 1951/52, when the progeny of corresponding short rains breeding in that area escaped to Arabia to breed, after a spectacular migration, throughout the Near East, control forces were heavily reinforced. In Somalia the Italian Trusteeship Authorities killed 35,000 hopper bands; the British Desert Locust Control units destroyed almost the entire hopper infestation over an area of 24,000 square miles in British Somaliland and, with the help of an air spraying unit provided by the United States Point Four Program, cleaned up a similar area in Ethiopia. As a result only a few small swarms migrated into

British East Africa, some remnants reaching Tanganyika.

The 1953 spring breeding in Arabia occurred over large areas across the peninsula, with hatching commencing in January along the southern Red Sea coast and in Oman, and spreading gradually northwards until April. The infestation continued through Israel, Jordan, Syria and Iraq to southeast Turkey which was invaded for the first time since 1945. In all these countries intensive hopper campaigns prevented any appreciable escapes.

The spring hopper infestation in Iran, resulting from parent swarms arriving direct from India and Pakistan and through Arabia, affected most of the southern half of the country and was particularly intense in Khuzistan. The campaign began in February and continued to the end of July. Operations were conducted over an area of a million hectares at a cost to Iran of U.S. $ 600,000. About 10 percent of this area was treated by aircraft; 6,600 tons of poison bait and 4,500 gallons of aldrin were expended. FAO provided 3,000 gallons of the aldrin and some BHC to the value of U.S. $ 35,000.

Completing the annual cycle in the Eastern Zone, Pakistan and then India were reinvaded from the west in May 1953, probably mainly by swarms escaping from Iran and Oman. The monsoon breeding which began in July and continued until the end of September was lighter than in 1952, but swarms escaped to migrate westwards back to Iran, where many swarms arrived in November, and perhaps to Arabia.

Whereas the locust situation in the east became, at least temporarily, more favorable, that in southwestern Arabia and the Somali Peninsula deteriorated, and in November and December 1953 was probably more critical than at any time during the present plague.

The infestation in the Somali Peninsula is particularly dangerous. Breeding began in October 1953 over vast areas including almost all Somalia, southern British Somaliland, adjoining areas of Ethiopia and northeastern Kenya. All available forces are being mustered to deal with the emergency and by the end of November 70,000 hopper bands had been destroyed in Ethiopian Ogaden alone.

From August to October heavy breeding took place in Yemen and adjacent coastal areas of Saudi Arabia, and although control work was extended in Yemen, mass escapes began to fly out northwards in October. Some of these appear to have migrated rapidly across Arabia, invading Jordan, Israel, Syria and Iraq in November; the majority will however remain to breed in Saudi Arabia.

A feature of the year was the build-up of the desert locust plague in the Western Region, due in part to infiltration from the east. In the autumn of 1952 isolated swarms were reported from the Sudan and Tchad and later in Niger Colony and French Sudan. During the summer of 1953 the infestation became more general and swarms reached the Atlantic coast of Mauretania in July. In October a considerable number of swarms invaded French Morocco and in November Algeria and Tunisia. This movement is likely to result in widespread spring breeding in North Africa from Morocco to Libya.

International Action

A sequence of control campaigns has continued without intermission throughout the period under review. The foregoing summary of the spread of the plague indicates the intricate pattern of the migrations and emphasizes how the locust attacks in all regions are interrelated, and how each campaign is an integral part of the collective effort to stem the plague. FAO aims at an overall appraisal in order to stimulate co-operative countermeasures.

By its provision of vehicles, anti-locust equipment and insecticides from the reserves built up in 1952, FAO contributed directly to the success of several campaigns, particularly those in Pakistan, Iran, Iraq, Jordan, Saudi Arabia, British Somaliland and Ethiopia. Concurrently, through instruction in air spraying techniques and by large-scale field operations, the United States Foreign Operations Administration gave strong support to the national campaigns in India, Pakistan, Iran, Iraq, and Ethiopia.

The practical benefit of assistance exchanged between the threatened countries was an outstanding feature of the 1952 campaigns. This policy extended in 1953 and further expansion is in view.

As a result of an emergency meeting convened by the Government of Jordan in March 1953 to devise plans for joint action, Lebanon, Saudi Arabia, Syria, Turkey, the United Kingdom and FAO contributed to the campaign in Jordan and adjacent areas of Saudi Arabia, the total cost of which was estimated at U.S. $ 364,000. The foreign assistance included personnel, 38 vehicles, 800 tons of bran and and 37 tons of BHC.

During the same period Iran also received considerable help which included 13 aircraft with pilots, 1,100 tons of bran, 106 tons of BHC, 46 tons of aldrin and 24 vehicles, contributed by India, Pakistan, Turkey, U.S.S.R. U.S.A., and FAO. The Government of the United States also provided $ 61,000 for the purchase of additional vehicles and insecticides. Neither Jordan nor Iran could have achieved success without assistance, and the neighbouring countries, by their participation, gained relief from intensified attacks.

At a meeting convened by FAO at Damascus in November 1953 attention was focussed on extending international co-operation within the Arabian Peninsula. This meeting, attended by representatives from 15 countries which are all liable to invasion by swarms derived from uncontrolled breeding in Arabia, agreed that the intensified efforts required to control the forthcoming spring breeding could be achieved only by concerted international action and recommended that such action should be co-ordinated by FAO.

Most of the countries represented indicated their willingness to contribute either control teams or equipment. The urgent problem of how and to what extent the recommendations might be translated into practical action was further discussed at the Seventh Session of the FAO Conference in Rome, November–December 1953. The Conference gave wholehearted support to the project and by authorizing the expenditure of U.S. $ 150,000 from the 1954 budget to match the direct contributions from countries, FAO is enabled to take an active part in the campaign. FAO's contribution will serve to meet the high running costs of the campaign, including such items as labor, petrol and transport, without which the international teams would be unable to operate.

The action taken at the Damascus Meeting and the FAO Conference marks an important step towards increased international action and exemplifies the modern approach to the desert locust problem.

Development of Control Techniques

Locust control techniques are under constant review. In the drive for greater efficiency, new methods are being evolved, particularly to speed up application and to economize material. During the past few years dry poison bait has amost entirely supplanted moist bait. Low volume sprayers are finding increased uses; the rôle of aircraft is extending.

The aerial application of aldrin against the desert locust was introduced by United States experts during 1951 in Iran. Subsequently this technique has become established in support of ground operations against hopper bands, and very large areas have been treated. Several countries are developing their own aerial units with pilots trained by the United States Point Four experts.

Attention is also being directed to the use of aircraft for air to air operations against flying locust swarms. To assist in the practical evaluation of this technique FAO placed four spraying aircraft at the disposal of Desert Locust Control. During the last two months these aircraft applied seven tons of concentrated insecticide on flying swarms and, to quote one example illustrating the potentialities of this technique, one swarm covering 30 square miles when in flight and so dense that it could be seen from a distance of 60 miles, was destroyed by the application of only 320 gallons of insecticide.

The Burrowing Nematode and Other Parasitic Nematodes in Relation to Spreading Decline of Citrus

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FROM work at the Florida Citrus Experiment Station it appears that "spreading decline" disease of citrus is a result of infestation of the feeder roots by the burrowing nematode, *Radopholus similis* (Cobb) Thorne. The first case of the spreading decline was found in the Lucerne Park area of Polk County before 1930. At present it is known to occur in 152 groves, mainly in Polk County with others in Highlands, Orange, Lake, and Hillsborough Counties. A typical diseased area consists of a group of stunted trees with fewer and smaller leaves, reduced yield, and a lack of feeder roots. Such trees wilt much more readily than healthy trees during dry periods. Trees affected by the spreading decline have been known to remain in an unthrifty condition for over 20 years but they do not die unless neglected. A decline area may appear at any point in the grove and thereafter spreads in all directions.

Investigations into the nature and control of the spreading decline started in 1945 and it has been found that the disease usually spreads through a grove at the rate of one or two trees on the margin of affected spots each year. Spread takes place irrespective of direction of cultivation; up hill or down; under paved, clay, or sand roads, and railroad tracks where the distance between trees is less than 100 feet; and into adjacent groves. No experimental evidence was obtained to indicate that the spreading decline was due to a nutritional deficiency, a soil toxin, a virus, or a fungus. The deterioration of the feeder root system in diseased trees plus some other characteristics, however, suggested the possibility of nematode infestation.

In 1947 the citrus nematode, *Tylenchulus semipenetrans* Cobb, was reported as associated with the spreading decline in some groves but subsequent investigation showed that this nematode was not the causal factor. On the other hand, evidence indicated strongly that another nematode might be involved. Further support to this postulate was obtained from the favorable response to experimental application of soil fumigants prior to replanting. Later, a study of the nematode populations in 50 groves showed a significantly higher population in decline as compared to healthy areas.

During the studies, a number of plant parasitic nematodes, which had not hitherto been reported on citrus in Florida, were discovered. One of these, the burrowing nematode, *Radopholus similis*, previously unrecorded on citrus anywhere, was established as the probable cause.

Root Development in Diseased Trees

In order to study the feeder root development in diseased trees as compared with that of healthy trees, root observation boxes were placed in August 1951 in both healthy and decline areas. In the decline area a new flush of feeder roots was observed on 7 September and brown regions were observed on them on 15 October. By 7 December all the visible feeder roots were in advanced stages of decay. In the healthy area root growth was evident by 17 September but no decay of the new feeder roots was noted by 7 December. These results were confirmed by growing sour orange seedlings in decline and healthy soil in small root observation boxes in the greenhouse during the winter.

Subsequent investigation on the feeder root distribution in mature citrus trees showed that trees affected by the spreading decline had usually no feeder roots in the soil below a depth of 30 inches, though larger secondary roots were present. During periods of active root growth, feeder roots were found developing below this depth, but they died

out in less than a month. In general, a diseased tree possesses about half as many feeder roots as a corresponding healthy tree, especially in the lower depths where feeder roots are absent except for short periods. Feeder root development in diseased and healthy trees does not differ greatly in the top foot of soil.

Relation of Soil Temperature to Disease Development

Progress had always been handicapped by the difficulty of reproducing the disease experimentally. In studies on the growth of citrus seedlings in pots, using soil from decline and healthy areas, no apparent differences were noted unless the pots were buried in the soil outside the greenhouse. The discovery that the destruction of the feeder roots of mature trees occurred chiefly below 2 feet suggested that the soil temperature might influence the development of the causal agent and that in pot experiments on greenhouse benches the soil temperature was too high. Thermograph records showed that the maximum temperature in the soil at a depth of 3 feet during the summer was 79° F., while at 6 inches it was 103°, indicating that the high temperatures near the surface might be a limiting factor.

To investigate this question, two tanks were constructed in which the soil temperature could be maintained at 74° to 78° F. Topsoil (0 to 6 inches) and subsoil (24 to 30 inches) samples were obtained from both the spreading decline and healthy areas of four groves and placed in 5-quart cans in the temperature control tank, five cans for each sample. Sour orange seedlings were planted in the cans on 8 August 1952, and fertilized each month. Within six weeks after planting it was apparent that none in the decline subsoil was making normal growth.

The experiment was continued until 30 March 1953, when seedlings growing in the decline subsoil were much smaller than those growing in the corresponding healthy subsoil. This difference was consistent for all four groves. On the other hand, there was no apparent difference between the seedlings grown in the topsoil from the decline and healthy areas. This was the first time it had been possible to produce symptoms of spreading decline consistently under experimental conditions.

Establishment of the Causal Agent

The discovery of the brown regions on feeder roots associated with decline in the root observation boxes in both the field and greenhouse, plus the finding of a larger nematode population in diseased as compared to healthy areas, indicated that the browning might be caused by a nematode. Accordingly feeder roots from trees in the diseased and healthy areas of 11 groves were dissected and examined. In all cases characteristic lesions were found on the feeder roots from the spreading decline trees but not from the healthy trees. These lesions, as an initial stage in the development of brown regions mentioned above, usually occurred on roots less than $^1/_{16}$ inch in diameter. Often the location of a lesion or cavity was recognized only by the presence of a small split or hole in the epidermis.

The burrowing nematode, *Rodopholus similis*, which is about $^1/_{50}$ inch long, was found in the lesions in numbers ranging from 1 to 25 depending on the age and size of the lesion. Further investigation revealed this nematode in lesions and cavities on feeder roots at soil depths as great as 12 feet.

A study of the nematodes infesting the feeder roots of the sour orange seedlings in the temperature–control experiment showed that the burrowing nematode was the only parasitic nematode associated with plants showing symptoms of spreading decline. This nematode was found on all of the plants growing in subsoil from the decline area of all four groves studied. This constitutes strong evidence that the burrowing nematode is the causal agent of the spreading decline.

During surveys to determine whether the burrowing nematode was present in all of the groves showing the spreading decline, 29 affected groves were examined. *R. similis* was found in the diseased area but not in the healthy area in 28 of these groves, and was not found in any of the 26 healthy groves examined. The one exception does not detract from the evidence, since sampling is difficult and frequently several samplings are necessary before the burrowing nematode is found. Its existence in cavities in the rootlet

does not permit ready detection with the sampling methods used for migratory nematodes.

The Burrowing Nematode and Its Control

The burrowing nematode occurs in tropical and subtropical regions of the world and was first identified by Cobb in 1893. It is known to attack the roots of pineapple, sugar cane, tea, coffee, banana, bamboo, nut grass, edible canna, pigeon pea and sweet potato. The nematode attacks the roots of citrus in the same manner as it does the roots of these plants, causing lesions and cavities in which it feeds and lives. When the infested rootlet decays the nematodes move to uninfested roots.

This is the first report of the natural occurrence under field conditions of *Radopholus similis* in Florida and the first time that this nematode has ever been reported infesting and extensively damaging citrus. So far, *R. similis* has been found causing injury to feeder roots of rough lemon (*Citrus limon*), sour orange (*C. aurantium*), sweet orange (*C. sinensis*), and grapefruit (*C. paradisi*). It has not been possible as yet to examine the mandarin group, *C. reticulata*, but results of earlier greenhouse experiments indicated that it is probably subject to attack. The variety of citrus budded on the rootstock has no apparent influence on the disease.

Field experiments on the control of the spreading decline have been in progress since 1948. Preliminary results from some of the experiments have indicated that the treatment of the soil with D-D soil fumigant, following the removal of the diseased trees, will be beneficial. However, no definite recommendations for the control of this disease can be made at this time. Thorough fumigation to kill all the nematodes will be extremely difficult since the nematodes have been found as deep as 12 feet.

The obvious solution would be the use of a resistant rootstock. The only indication of resistance was the finding of three trees that had escaped the disease in three different infested areas. The stocks of these three trees are being propagated for further study. A large number of miscellaneous rootstocks not commonly used commercially are also being tested.

The finding of a control for a nematode of this type will not be easy. Little is known concerning either its host range or its susceptibility to chemical treatment, and the depth to which it occurs will certainly increase the difficulty of soil treatment.

Other Nematodes Associated with Citrus Roots

In addition to the burrowing nematode many other nematodes were observed in association with citrus feeder roots in the samples obtained from numerous groves in Florida. Members of the Dorylaimidae were commonly present but the majority are not known to be parasitic. Eight other plant-parasitic nematodes were found frequently.

The citrus nematode, *Tylenchulus semipenetrans* Cobb, first found in California and first reported on citrus feeder roots in Florida in 1913, feeds on the citrus roots and causes a decline of weak trees. Since 1947, although a total of 209 groves has been examined, this nematode was found in only 7 out of 77 groves affected by spreading decline and in 17 groves showing another type of decline. It was also found in 12 out of 115 apparently healthy groves. As previously mentioned, the citrus nematode is not the cause of spreading decline.

The sting nematode, *Belonolaimus gracilis* Steiner, damages the roots of pines, vegetables, some grasses, and strawberries in Florida. Recently it was also reported as causing possible damage to citrus roots. During the present investigations, 68 groves were examined and the sting nematode was found in only 9 out of 39 groves with the spreading decline, and in 14 out of 29 groves without this disease. In two groves with the spreading decline, the sting nematode was found in the healthy but not in the diseased area, while in another grove this nematode was present in both. These results indicate that *B. gracilis* is not related to the spreading decline, although it may be a factor in other types of decline.

Aphelenchus avenae Bastian, a facultative parasite which may feed on the roots of plants or on fungi in the soil, has been reported from citrus roots in Rhodesia. This nematode was found to be associated with citrus feeder

roots in 25 groves. Apparently it is not a factor in the spreading decline, since it was present in diseased and healthy areas in the same grove and also in healthy groves free from the decline.

Hoplolaimus coronatus Cobb has been found associated with the roots of pine seedlings in Florida and has been reported from the roots of sugar cane, maize, alfalfa, and red clover. During this study it was found associated with citrus feeder roots in both the spreading decline and healthy areas in two groves, in six groves in the decline area only, and in one grove in the healthy area only. It was also present in eight healthy groves.

The meadow nematode, *Pratylenchus pratensis* (de Man) Filipjev, which has been reported associated with citrus roots in California and in Brazil, was found in two groves in the spreading decline area only, and in seven groves in the healthy area only. It was also found in two healthy groves.

The stubby-root nematode, *Trichodorus* sp., causes root damage to vegetable crops in Florida and has recently been found associated with citrus feeder roots by V.G. Perry and J.R. Christie. During the present work, the stubby-root nematode was found in eight groves in the spreading decline area only, in two groves in both decline and healthy areas, and in two groves in the healthy area only. In addition, it was found in five healthy groves.

The dagger nematode, *Xiphinema americanum* Cobb, has occasionally been found associated with citrus roots in Texas. It was found in Florida in the decline area in only one grove, in the healthy area in another grove, and in seven healthy groves.

Hemicycliophora sp., which is known to feed on the cortex of the roots of some plants, was found associated with citrus feeder roots in the spreading decline area in one grove, and in two apparently healthy groves.

Hoplolaimus coronatus, *Pratylenchus pratensis*, *Trichodorus* sp., *Xiphinema americanum*, and *Hemicycliophora* sp. are probably not related to the spreading decline. Although they have been found associated with citrus feeder roots, the type and extent of injury has not as yet been determined.

Some of these nematodes had not previously been reported in association with citrus feeder roots: *Hoplolaimus coronatus* and *Hemicycliophora* sp. not at all, as far could be determined; *Aphelenchus avenae* not in the United States; *Pratylenchus pratensis* and *Xiphinema americanum* not in Florida.

Transmission of Tobacco Mosaic by Citrus Mealybug

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THE citrus mealybug, *Planococcus citri* (Risso) has been found by the writer capable of transmitting tobacco mosaic in Ceylon. This substantiates the unconfirmed report of Olitski [1] published nearly thirty years ago.

A tobacco plant infected with two viruses, tobacco mosaic and Storey's leaf curl, and a number of healthy seedlings, became infested accidentally with the mealybug, identified as *Planococcus citri* by the Commonwealth Institute of Entomology. The virus infected plant was under investigation in the hope that the dual infection, a common occurrence in Ceylon, might be sap transmitted as such. Repeated trials proved, however, that only the tobacco mosaic fraction was sap transmissible.

Since Storey's leaf curl is readily transmissible by the white fly, it seemed possible that the citrus mealybug might also transmit this virus. Well developed mealybugs were therefore transferred from the dual virus-infected plant to five healthy seedlings of the same variety, Harrison's Special, four to each plant. All five seedlings, contrary to expectations, developed the typical symptoms of tobacco mosaic. No symptoms were shown on the plants used as controls, upon which mealybugs from healthy seedlings had been placed. Secondary transfers to two groups of five seedlings were also all successful. As indicated by the absence on these seedlings of leaf enations and curl, the characteristic symptoms of Storey's leaf curl, and in comparison with the symptoms developed through sap transmission, it was evident that the tobacco mosaic fraction only was transferred by the citrus mealybug. Viruliferous mealybugs from the same colony were placed on *Nicotiana glutinosa* plants, four to single leaves on each plant, but only in a few cases did local lesions appear within three days, although all the mealybugs had previously fed for seven days on the mosaic infected plants as in the tobacco to tobacco trials. One to three local lesions appeared on each leaf at feeding points within three days only when the number of insects was increased to ten in the five trials that were conducted.

The experimental results briefly summarized above are believed to provide conclusive evidence that tobacco mosaic is transmissible by the citrus mealybug.

[1] OLITSKI, P. K. *The transfer of tobacco and tomato mosaic by the Pseudococcus citri.* Science 62:442. 1925.

Occurrence of the Cotton Pink Bollworm in Eritrea

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THE cotton pink bollworm (*Platyedra gossypiella* Saund.) was not known to exist in Eritrea until 1952, though it has been prevalent for many years in the Sudan and Somalia. In 1952, this destructive insect was found for the first time at the Tessenei Estate, which comprises an area of about 40,000 acres situated on the lowland of the left bank of the Gasc River near the border between Eritrea and the Sudan. In 1953 about 10,000 acres of the estate were under cultivation, of which about 4,000 acres were under cotton.

Origin of Infestation

In 1926 during a brief mission to Tessenei to investigate entomological problems of cotton, I failed to find the pink bollworm. Furthermore, as two other common bollworms, *Earias biplaga* Walk. and *Diparopsis castanea* Hamps. occurred only infrequently, entomological conditions appeared favorable for the development of cotton growing. In a report published later[1], I suggested various measures necessary to keep that area free from the pink bollworm and recommended, among other things, that the lowland be flooded should the pest be introduced accidentally. At the end of 1939, Jannone[2] ascertained again that the pink bollworm had not been found in that area.

From 1941 to 1949, the Tessenei Estate was under British management and only durra (*Sorghum vulgare*) and bultuc (*Pennisetum typhoideum*) were grown, as required for the feeding of the local population. In 1949, the Italian company, Società Imprese Africana, again took possession of the estate, and cotton growing was resumed over a small acreage in 1950 and expanded in 1951 using cottonseed imported from the Sudan. The pink bollworm was probably introduced through the infested cottonseed.

A small sample of green cotton bolls infested with insects was received in April 1953 from Tessenei by the Laboratorio di Entomologia agraria of the Istituto Agronomico per l'Oltremare in Florence for identification. In this sample I observed the larvae of the pink bollworm together with larvae of *Earias* spp. and of *Diparopsis castanea*.

The occurrence of the pink bollworm at Tessenei presents a serious threat to cotton culture in Eritrea. Whether this pest is also present in the older cotton growing districts, such as Barentù, Om Hager, etc. is not yet known and a survey to determine its present range of spread is urgently needed.

Suggested Measures

In view of the destructiveness of the pink bollworm, the following measures are suggested to eradicate the existing infestation and to prevent its further spread.

1. The importation of cottonseed from countries or territories, in which the pink bollworm is known to occur, for instance, the Sudan, should be prohibited.
2. Cottonseed imported or produced locally should be disinfested by effective means.
3. Crop refuse should be destroyed immediately after harvest.
4. Cultural practices which may reduce the prevalence of the pink bollworm should be investigated with view to adoption. In particular, a proper crop rotation system with a two years' close season for cotton or other malvaceous plants should be followed, even

[1] CHIAROMONTE, A. *Una particolare circostanza favorevole allo sviluppo della cotonicoltura a Tessenei: l'assenza di Platyedra gossypiella, Saund.* Agric. Colon. (Italy) 24: 185–188. 1930.

[2] JANNONE, G. *Principali cause di natura animali riscontrate dannose all'agricoltura dell'Africa Orientale Italiana durante il 1939.* Agric. Colon. (Italy) 34: 177–185, 241–253, 287–298. 1940.

if it be against the immediate interests of the growers.

5. Wild plants of the family Malvaceae and related families may serve as shelters for the pink bollworm during the season where there is no cotton in the field. Such plants should be destroyed under the supervision of entomologists, who should take into consideration the biological complex. For instance, in the Sudan it has been found that the larvae of *Crocidosema plebelana* Zell. living on *Abutilon* are often parasitized by the Braconid, *Microbracon kirkpatricki* Wlkn., which is a very efficient parasite of the larvae of the pink bollworm. In such a case the destruction of *Abutilon* would be harmful because this weed would help to perpetuate a valuable parasite.

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FROM PREVIOUS ISSUES

Outbreaks and New Records

Canada

C. G. MacNay

Entomology Division
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The following records, made in 1952, are of insects new to Canada but previously reported elsewhere in North America. New Canadian records for 1952 of insects not previously reported in North America were published earlier.[1]

Tomato Russet Mite

The tomato russet mite, *Vasates destructor* (Keif.), appeared on tomatoes in a greenhouse near Harrow, Ontario. It was first recorded on this continent in California, U.S.A., in 1940, and has since spread throughout much of that country, including several States bordering Eastern Canada; damaging infestations have occurred in the field as well as the greenhouse.

Lygus Bug on Mustard

The plant bug, *Lygus nigrosignatus* Kgt., was reported to be abundant on cultivated mustard in Alberta, from Coutts eastward to Clarinda. The insect was previously described from Washington and Idaho, U.S.A., where it was taken with other species on alfalfa, and was reported to have caused injury to the fruit of peach.

Plant Bug on Wheatgrass

The plant bug, *Irbisia arcuata* Van D., caused considerable damage to the intermediate wheatgrass (*Agropyron intermedium*) grown at the Experimental Station at Lethbridge, Alberta. The only records in the United States are from Colorado, where it was collected in small numbers at altitudes of 8,000 ft. and higher.

Two New Grasshoppers

The grasshopper, *Psinidia fenestralis* (Serv.), was recorded from one male specimen collected at Berthier, Quebec. The species occurs from Wisconsin eastward to the Atlantic coast in the United States, and inhabits sand dunes held by the American beachgrass (*Ammophila breviligulata*).

The long-horned grasshopper, *Scudderia septentrionalis* (Serv.), was recorded from two female specimens taken at Lachute, Quebec. The species occurs from Wisconsin eastward to the Atlantic in the United States.

Brown-Headed Ash Sawfly

Larvae of the brown-headed ash sawfly, *Tomostethus multicinctus* (Roh.), were found feeding on three ash trees in London, Ontario. The insect has been known to be present in eastern and central areas of the United States for some time. It is often a serious defoliator of red ash (*Fraxinus pennsylvanica*) and white ash (*F. americana*), particularly when they are grown as shade trees.

[1] MacNay, C.G. *Outbreaks and new records: Canada.* FAO Plant Prot. Bull. 2: 28–29 1953.

Aphids on Pine and Juniper

Cinara murrayanae (G. & P.) was collected from the bark and smaller branches of lodgepole pine (*Pinus contorta* var. *latifolia*) at Hardisty, Alberta, and Indian Head, Saskatchewan. *C. juniperi* Deg. was collected from *Juniperus communis* at Sault Ste. Marie, Ontario. It had been recorded in 1929 on juniper imported into British Columbia from Holland, but it was not known to have been established in Canada at that time.

Curculio on Hollyhock

A widespread infestation of the curculionid, *Apion longirostre* Oliv., occurred on hollyhock in the area about Chatham, Ontario. It had been recorded previously in the United States from Georgia, in 1914 and 1922, and later from Ohio westward to Missouri. It has been abundant on hollyhock along the southern shore of Lake Erie in recent years. Since its distribution in Europe is restricted to the Mediterranean region, it is not expected to spread far northward in Canada.

Pyralid in Warehouse

The pyralid, *Aphomia gularis* Zell., was found infesting a warehouse in Vancouver, British Columbia. It had been recorded on only one other occasion in Canada, namely, at Montreal, Quebec, in 1934, but had apparently not become established in this country. The insect is a pest of stored rice, nuts and dried fruit.

Cereal Pest in Mill

The tenebrionid, *Cynaeus angustus* (Lec.), previously recorded in Canada in a local infestation of grain at Diana, Saskatchewan, in 1944, was found in abundance on cereal products in a mill at Medicine Hat, Alberta. The insect is not uncommon in southern North America, where it is a comparatively minor pest of stored grain and cereal products.

Merchant Grain Beetle

The cucujid, *Oryzaephilus mercator* (Fauv.), commonly called the merchant grain beetle, infested insect specimens in a collection at Ottawa, Ontario. Although this is the only known infestation in Canada, the species is cosmopolitan. Its distribution and economic importance, however, are not definitely known because of confusion with *Oryzaephilus surinamensis* (L.) from which it differs little in appearance and feeding habits.

Gilbert Islands

W. J. Hall

Commonwealth Institute of Entomology, London

Icerya aegyptiaca: a New Record

Icerya aegyptiaca Dougl. appears to be a recently introduced insect pest in the Gilbert Islands in the west Pacific Ocean. Information on its presence in these islands was first received in August 1953, when the pest was severely infesting breadfruit (*Artocarpus altilis*) and several other species of plants on the Islands of Butaritari and Makin. Specimens received later were identified as *I. aegyptiaca*, which was confirmed by the Commonwealth Institute of Entomology. More recently this pest was reported from the Island of Tarawa.

A colony of the introduced Australian coccinelid, *Rodolia cardinalis* Muls., was sent from Fiji and has been liberated at Butaritari for the control of *I. aegyptiaca*.

The above information was communicated to the Commonwealth Institute of Entomology by Mr. B.A. O'Connor, Senior Entomologist, Department of Agriculture, Suva, Fiji, on behalf of the District Commissioner, Tarawa, the Gilbert and Ellice Islands Colony.

Netherlands New Guinea

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Section of Agricultural Research
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Control of European Corn Borer

In the Research Center at Kota Nica, Hollandia, a close season for maize of 3 ½ months was introduced as a measure for controlling the European corn borer (*Pyrausta nubilalis*), after it had caused serious losses during the last months of 1952. During the close season, residues and refuse from the previous crop were destroyed. Maize grown after this period was found to suffer only negligible losses from the borer. Trials will be carried out to ascertain if the beneficial effects were due to the close season or to the seasonal variation in the development of the borer.

Rice Borers

The rice crop in Sankorum in the Manokwari District was considerably damaged during July and August 1953 by the white rice borer (*Scirpophaga innotata*) and an unidentified borer.

United States

Bureau of Entomology and Plant Quarantine
United States Department of Agriculture, Washington, D.C.

Cotton Stem Moth Survey

A survey was conducted during the summer of 1953 to determine the distribution of the cotton stem moth (*Platyedra vilella* Zeller) in the eastern United States. Since the larvae commonly infest hollyhock seeds and stems, observations were made primarily on this plant. Specimens of *P. vilella* were identified from 16 widespread locations on Long Island, New York, where the insect was found for the first time in the United States in 1951, and one location in Westchester County, New York. Specimens were also collected at two places in Connecticut, and at two places in Massachusetts. The insect had not been recorded as occurring in Connecticut and Massachusetts prior to this survey.

New Grain Storage Pest in California

A recent communication from California reports an infestation of a dermestid (*Trogoderma granarium* Everts), sometime called the Khapra beetle. The infestation was found in wheat and barley stored in elevators in Tulare County, central California. Wheat was the more heavily infested.

While this is apparently a first official record for this species in the United States, investigations by California officials reveal that the insect probably occurred at Fresno, California, as early as 1946. Infestations have now been reported from the Los Angeles area in that State. Literature shows *T. granarium* to be a widespread storage pest of wheat, barley, rice and sometimes oats in Eurasia, Madagascar, and Australia.

Pink Bollworm Recorded in New Areas

Pink bollworm, *Pectinophora gossypiella* (Saund.), was found for the first time in the State of Arkansas during November, 1953. Single specimens of larvae were collected in Hempstead and Miller Counties. Surveys show that this serious pest of cotton is extending its range in Louisiana and Oklahoma with four parishes and nine counties, respectively, recorded as newly-infested this year.

PLANT QUARANTINE ANNOUNCEMENTS

Argentina

Decree No. 10869 of 17 June 1953, published in the *Boletin Oficial*, Vol. 61, No. 17465, 21 August 1953, prohibits the importation of olive plants or parts thereof, on account of the risk of introducing parasites non-existent in Argentina. Imports consigned to the Ministry of Agriculture and Animal Husbandry for experimental purposes, or to complete private collections of varieties, will be permitted. In either case, they will be disinfected.

The olive plants or parts thereof thus introduced must be accompanied by a certificate of health and a certificate of varietal validity, issued by a competent authority of the country of origin, and must enter through the Port of Buenos Aires.

Mauritius

Proclamation No. 23 of 14 August 1953 revokes Proclamation No. 7 of 6 February 1952 which prohibited the importation into Mauritius of maize seed or any part of the maize plant from West Africa, including the Cameroons, Spanish Guinea and French Equatorial Africa. The prohibition was aimed at preventing the introduction of the maize rust disease caused by *Puccinia polysora*, but this disease has recently been found to exist in Mauritius. 33, p23

Netherlands

Order No. L/PA 984 of 14 September 1953 relating to the importation and transit of potatoes was published in the *Nederlandse Staatscourant*, No. 180, 17 September, and came into operation 1 October.

The importation of potatoes into the Netherlands and their transit through the country shall be permitted only if accompanied by two copies of a statement issued by the competent authority of the country of origin, stating that the consignment has been inspected by a duly authorized officer and to the best of his knowledge found free from potato wart (*Synchytrium endobioticum*); further that this disease has never been observed on the place where the potatoes were grown. One copy of this statement must be forwarded to the Netherlands Plant Protection Service by the Customs officers as soon as the consignment arrives at the point of entry.

The above order was issued because former regulations included in the Potato Decree of 1935 for potatoes originating from Germany, Great Britain and Poland were abrogated when the Potato Decree was replaced by the Potato-Wart-Disease Decree of 7 March 1953. The Potato-Wart-Disease Decree provides measures for combating this disease within the country and prohibits the export of diseased potatoes, but does not include provisions relating to the import of potatoes.

Union of South Africa

Proclamation No. 186 of 11 August 1953, published in the *Government Gazette*, Vol. 173, No. 5126, 28 August 1953, amends Proclamation No. 286 of 1936 concerning restrictions on the importation of plants, fruit, potatoes, etc., by adding the following requirements to potatoes.

Importation of potatoes is prohibited after 1 September 1954 from any territory overseas, or from Portuguese East Africa or any territory north of the Zambesi River, except Northern Rhodesia, Nyasaland and the Belgian Congo, unless the importer produces a certificate from the Department of Agriculture or some recognized official institution of the country of origin, certifying that the potatoes were grown in soil tested not more than one year before despatch and found free from the nematodes, *Heterodera schachtii*, *H. rostochiensis*, *H. punctata* and *H. major*. Such a certificate shall not be required if any one of the following conditions has been complied with:

(*a*) If the Government of the country of origin has certified to the Minister of Agriculture that these nematodes have not been known to exist in that country, and that the Government will undertake to inform the Minister of any outbreak.

(*b*) If the consignee produces from the Department of Agriculture, or other official institution of the country of origin, a certificate dated within 9 months of the day of arrival of the potatoes, indicating that these nematodes have not been known to exist in the growing area.

(*c*) If, in cases in which special arrangements have been made, a certificate is produced from the Department of Agriculture, or other official institution of the country of origin, stating that on official inspection the potatoes and soil adhering to them were found to be apparently free from these nematodes.

Viet-Nam

Orders No. 63 to No. 69–BCN–ND of 11 August 1953, published in the *Journal Officiel du Viet–Nam*, Vol. 6, No. 45, 29 August 1953, provide special measures restricting the importation of specific plant materials. In all cases, the materials permitted to be imported are subject to

inspection by the plant inspection service. These orders came into force 1 July 1953 and revoked all the previous provisions contrary to those of the present orders.

Hevea rubber (Order No. 63). Plants, parts of plants, fruits and seeds of all species of *Hevea*, as well as soil and packings accompanying them, are prohibited importation; except that the following materials, if originating from a country not declared to be infested, may be imported under specified conditions.

1. Seeds for planting and free from hulls must be shipped in sacks or containers and accompanied by a phytosanitary certificate of the country of origin indicating the number of containers and the origin of the shipment.
2. Root stocks and bud wood must be shipped in closed containers or packings and accompanied by a phytosanitary certificate indicating the number of containers and the origin. The stocks are subject to quarantine for two years, or destruction, and the bud wood subject to destruction.

The territories declared to be infested by *Hevea* diseases and pests are: the intertropical regions of the American continent and all intertropical islands between 30° and 130° longitude west.

Cotton (Order No. 64). Plants, parts of plants, fruits, seeds and cottonseed cakes of all species of cotton, *Hibiscus* and *Bauhinia*, as well as soil and packings accompanying them, are prohibited importation; except that the following may be imported under specified conditions:

1. Seeds for sowing and delinted, if originating from a country not declared infested, must be shipped in sacks or closed containers and accompanied by a phytosanitary certificate. They will be disinfected on entry.

For the importation of such seeds originating from a country declared infested, the importer must obtain in advance an import authorization from the plant inspection service. The seeds must be shipped in sacks or closed containers, sealed or marked by the competent service of the country of origin which will attest on the phytosanitary certificate that the seeds had been disinfected before being packed. They will be disinfected again on entry.

2. Cotton lint destined for local industries must comply with the following conditions. Cotton bales shall not be opened until arrival in the factory unless it is deemed necessary to examine them in the port. Manufacturing waste, especially seeds and refuse thereof, shall be burned and the packings disinfected by heat in the factory. Plants of the family Malvaceae and of the genus *Bauhinia* within a radius of 300 meters around the factory must be destroyed.

The territories declared infested by cotton diseases and pests are: Asia, Australia, New Caledonia, New Hebrides, Samoa, Hawaii, Brazil, Mexico, New Mexico, Texas, Louisiana, Puerto Rico, British Antilles, Egypt, Sudan, Somaliland (Italian administration), Nigeria, Angola, Sierra Leone, Lagos, Belgian Congo, British East Africa, Tanganyika, Greece.

Sugar cane (Order No. 65). Plants, parts of plants and seeds of sugar cane, as well as soil and packings accompanying them, are prohibited importation; except that the following may be imported under specified conditions.

1. Seeds exclusively for sowing and free from hulls, if originating from a country not declared infested, must be shipped in perfectly closed metal containers and accompanied by a phytosanitary certificate indicating the number of containers and the origin of the seeds. They will be disinfected on entry.

For the importation of such seeds originating from a country declared infested, an import permit must be obtained in advance from the plant inspection service and the seeds shall be shipped in perfectly closed metal containers marked by the phytosanitary service of the country of origin, which will attest in the phytosanitary certificate that the seeds have been disinfected before being packed. Such seeds will be disinfected again on entry.

2. Cuttings originating from a country not declared infested may be imported under an authorization issued in advance by the plant inspection service. They must be shipped in packages of not more than 20 and accompanied by a phytosanitary certificate indicating the number of packages and the origin. After inspection, the cuttings will be destroyed or quarantined for two years.

Countries declared infested by sugar cane diseases and pests are: Hawaii Islands, Formosa, Philippines, New Guinea, Fiji, Australia.

Tea (Order No. 66). Plants, parts of plants, leaves, and seeds of all species of tea, as well as soil and packings accompanying them, are prohibited importation; except that the following may be imported under specified conditions.

1. Seeds for sowing must be shipped in closed containers weighing not more than 2 kg. and be accompanied by a phytosanitary certificate giving details of the shipment. They will be disinfected on entry.
2. Root stocks must be shipped in containers or closed packings and accompanied by a phytosanitary certificate indicating the number of packages and the origin. They will be subject to quarantine for one year, or destroyed.
3. Leaves under the commercial names of black or green tea must be accompanied by a phytosanitary certificate.

Fruits (Order No. 67). Importation is permitted of fruits originating in countries not declared infested by the Mediterranean fruit fly (*Ceratitis capitata*). Importation is prohibited from

the following countries recognized as being infested by the fly.

Europe :	France, Spain, Italy, Sicily, Greece, Madeira, Azores, Malta, Turkey.
Asia :	Syria, Palestine, Cyprus.
Africa :	African continent, Canary Islands, Cape Verde Islands, Mauritius.
America :	Argentina, Brazil, Bermuda Islands.
Oceania :	Australia, New Zealand, Hawaiian Islands.

As an exception, fruits originating from France, Algeria, Tunisia, Morocco, Union of South Africa and Australia, may be imported if accompanied by a phytosanitary certificate indicating the details of the shipment and the name of the importer.

Banana (Order No. 68). Banana plants and parts thereof, as well as soil and packings accompanying them, are prohibited importation if originating from the following territories, which are declared infested by banana diseases and pests: American continent, Antilles, Canary Islands, Sierra Leone, Gold Coast.

Such plants originating from a country not declared infested may be imported on condition that they be conveyed in packages containing not more than 10 plants and accompanied by a phytosanitary certificate. They shall be subject to quarantine for one year, or destroyed.

Coffee (Order No. 69). Plants, parts of plants, berries, and seeds of all species of coffee, as well as soil and packings accompanying them, are prohibited importation, except that the following may be imported under specified conditions.

1. Coffee beans for use as seed and in parchment, originating in countries not declared infested, must be conveyed in closed metal containers weighing not more than 2 kg. and accompanied by a phytosanitary certificate indicating the number of containers and the origin of the shipment. They will be disinfected on entry.

2. Green coffee with parchment removed and roasted coffee destined for consumption, if originating from a country not declared infested, must be accompanied by a phytosanitary certificate attesting particularly that the coffee is free from the coffee berry borer (*Stephanoderes hampei* = *S. coffeae*) and that this insect does not exist in the country of origin.

For the importation of such coffee originating from a country declared infested, an import permit must be obtained in advance from the plant inspection service and the shipment must be accompanied by a phytosanitary certificate giving details of the shipment.

3. Root stocks originating in countries not declared infested must be conveyed in sacks free from all coffee debris and be accompanied by a phytosanitary certificate. After inspection they will be grown under quarantine for one year or destroyed.

Countries declared infested by coffee diseases and pests are: Indonesia, British Antilles, French Equatorial Africa, Belgian Congo, States of South America, Malaya, Thailand.

NEWS AND NOTES

Republic of the Philippines ratifies the International Plant Protection Convention

The Government of the Republic of the Philippines, whose representative signed the International Plant Protection Convention on 6 December 1951, deposited the instrument of ratification with the Director-General of FAO on 3 December 1953. This brings the number of countries contracting to the Convention, including both signatory and adhering members, to nineteen, namely: Australia, Austria, Belgium, Cambodia, Canada, Ceylon, Chile, Denmark, Dominican Republic, Egypt, El Salvador, India, Indonesia, Japan, New Zealand, Republic of the Philippines, Spain, Sweden and the United Kingdom.

Rectification of the Spanish Text of the International Plant Protection Convention

The English, French and Spanish texts of the International Plant Protection Convention are of equal authenticity. However, when the Convention was printed during the Sixth Session of the FAO Conference in 1951, for signature by the representatives of Member Governments, several words, by a regrettable oversight of the printers, were omitted from the Spanish version of the text approved by the Conference. The Director-General of FAO in 1952 drew the attention of Member Governments to these omissions and suggested that the Spanish text be appropriately amended by the Conference at its next Session. Furthermore, it would appear desirable to make slight modifications in the Spanish version to eliminate minor discrepancies between the Spanish text and the English and French texts.

Modifications of the authentic Spanish version of the Convention to the effect mentioned above were accordingly proposed to and approved by the Seventh Session of the FAO Conference, 23 November–11 December 1953. The approved Spanish text will be available shortly for general distribution.

Roma - Tip. del Senato del dott. Giovanni Bardi

CEREAL BREEDING PROCEDURES

This FAO Development Paper covers the whole field from the hybridization of the parent plants until a new variety is in commercial production. Methods of growing hybrid populations, systems of testing and recording of results, variety purification and increase of pure seed, as well as the analysis of data, are treated in detail. Various types of nurseries are described for the breeding of varieties resistant to plant diseases and insect pests, and tolerant to certain climatic factors such as frost.

Special features of the publication are the sixteen appendices which graphically illustrate planting plans, plot arrangements, the statistical progress of a cross, variety purification and other features of a cereal breeding program. The complexity involved in modern plant breeding methods and the consequent necessity of systematizing the procedures are clearly and impressively indicated, 122 pages, $ 1.25; 6s. 6d.

LEGUMES IN AGRICULTURE

This unique collection of information on legumes, edited by R. O. Whyte, G. Nilsson-Leissner and H. C. Trumble, required the collaboration of specialists in every Member Country of FAO. No fewer than 111 contributors are acknowledged, and contributions from many more are mentioned in the text.

Nowhere else is such information available in one volume and, by pointing to the limitations in the data on economic botany, ecology and the biotic relationships of legumes it is hoped to encourage further research and experiment particularly in tropical and sub-tropical areas. An appendix tabulates the species, indicating plant characteristics, climatic adaptation, soil adaptation, utilization, number of seeds per pound and seeding rates in pounds per acre. 368 pp., many illustrations, $ 3.00; 15s.

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